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Can Decentralization Encourage Equality in the Patent System?

Lital Helman

INTRODUCTION

In principle, the patent system is equally accessible to all inventors.[1] Big corporations, small start-ups, and individuals all have their patent applications scrutinized by the same patent office. If granted, their patents receive the same protection, duration, and remedies.[2] This equality principle serves an important purpose. It guarantees a neutral position of patent law and pledges equal opportunity to all inventions to win in the marketplace.[3] Theoretically, equality serves another vital objective: to ensure diversity of inventions.[4] It does so by giving new and small inventors the same treatment as experienced and well-known inventors and not granting an advantage to inventors who may be perceived as having a higher chance of success.

However, the patent system is not equally accessible to all. Some actors are more likely than others to file for patents and have their patents granted.[5] Thus, patents are

[1] *See generally* Wendy J. Gordon, *A Property Right in Self-Expression: Equality and Individualism in the Natural Law of Intellectual Property*, 102 YALE L.J. 1533 (1993) (discussing equality in intellectual property under Lockean principles).

[2] *See* 35 U.S.C. § 154(a)(1) ("Every patent shall contain . . . a grant to the patentee, his heirs or assigns, of the right to exclude others from making, using, offering for sale, or selling the invention . . . ."); *see also* Abraham Bell & Gideon Parchomovsky, *Reinventing Copyright and Patent*, 113 MICH. L. REV. 232, 234 (2014) ("Whatever the patent, the law offers a monopoly consisting of a specified set of rights over the invention for a fixed period of time."). An obvious exception to this rule is the availability of patent term extension for certain products that require regulatory approval. *See* Drug Price Competition and Patent Term Restoration Act of 1984, Pub. L. No. 98-417, 98 Stat. 1585 (codified as amended at 21 U.S.C. § 355 and 35 U.S.C. §§ 156, 271, 282).

[3] *See infra* Section 9.1.

[4] *See* Peter Lee, *Toward a Distributive Agenda for U.S. Patent Law*, 55 HOUS. L. REV. 321, 366–67 (2017) ("It seems likely that minority, women, and low-income inventors would be well situated to develop technologies sensitive to the needs of such communities.").

[5] See, for example, Alex Bell, Raj Chetty, Xavier Jaravel, Neviana Petkova & John Van Reenen, *Who Becomes an Inventor in America? The Importance of Exposure to Innovation* (Nat'l Bureau

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more handily granted to men over women, whites over minorities, and big companies over start-up firms.[6] Granted, this reality is largely a product of the broader phenomenon of inequality in other spaces, such as academia and entrepreneurship, rather than a feature of the patent system per se.[7] Yet, in this chapter, I propose that a decentralized design of the patent system, particularly the patent record, can mitigate this inequality. Although this chapter focuses on the patent system in the United States, much of the analysis can apply to patent systems worldwide.

The extant patent system in the United States is centralized almost from end to end. The U.S. Patent and Trademark Office (PTO) is responsible for examining patent applications, publishing the granted patents, and increasingly managing postexamination proceedings.[8] For a number of reasons, the centralization of all of these functions within the PTO has adverse effects on equality. First, the current system involves high entry costs and requires particular know-how that benefits repeat players and highly capitalized inventors. Second, centralization requires a single agency to examine the entire pool of patent applications. The immense quantity of patent applications compels examiners to use decision shortcuts and proxies. It should come as no surprise that these shortcuts work in favor of big and repeat players and to the disadvantage of traditionally underrepresented groups in the patent system. Third, the current system grants many unmerited patents, mainly to big corporations.[9] These patents create barriers to entry for newcomers. Finally, the current system features a limited patent record – a static registry that holds only

of Econ. Rsch., Working Paper No. 24062, 2017) (finding inventorship disparities based on parental income, gender, race, and ethnicity); Kjersten Bunker Whittington & Laurel Smith-Doerr, *Women Inventors in Context: Disparities in Patenting across Academia and Industry*, 22 Gender & Soc'y 194 (2008) (discussing gender disparities in inventorships); Scott A. Shane, The Illusions of Entrepreneurship: The Costly Myths That Entrepreneurs, Investors, and Policy Makers Live By 134 (2008) (same); Michael W. Schuster, R. Evan Davis, Kourtenay Schley & Julie Ravenscraft, *An Empirical Study of Patent Grant Rates as a Function of Race and Gender*, 57 Am. Bus. L.J. 281 (2020) (examining the rate at which patent applications are granted as a function of the inventor's race and gender). *See also infra* note 51 and accompanying text.

6 *See infra* Section 9.1.

7 See, for example, Paul A. Gompers & Sophie Q. Wang, *Diversity in Innovation* 14 (Harv. Bus. Sch., Working Paper No. 17-067, 2017) (discussing the low share of women entrepreneurs); Dana Kanze, Laura Huang, Mark A. Conley & E. Tory Higgins, *We Ask Men to Win and Women Not to Lose: Closing the Gender Gap in Startup Funding*, 61 Acad. Mgmt. J. 586 (2018) (discussing gender gaps in venture funding); Jessica Milli, Emma Williams-Baron, Meika Berlan, Jenny Xia & Barbara Gault, Equity in Innovation: Women Inventors and Patents 20–21 (2016), https://iwpr.org/wpcontent/uploads/wpallimport/files/iwprexport/publications/C448%20Equity%20in%20Innovation.pdf (discussing entrepreneurial effects of gender stereotypes); Maya A. Beasley & Mary J. Fischer, *Why They Leave: The Impact of Stereotype Threat on the Attrition of Women and Minorities from Science, Math and Engineering Majors*, 15 Soc. Psych. Educ. 427 (2012) (discussing attrition of minorities and other groups from STEM studies).

8 *See infra* note 32 and accompanying text.

9 *See infra* notes 25–26 and accompanying text.

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basic information about inventions. Acquiring updated and relevant information regarding the technological, legal, or commercial status of inventions is costly. The cost barrier places underfunded inventors at a disadvantage and at risk of falling victim to patent trolls.[10]

In a recent work, I considered an idea to decentralize the patent system.[11] In particular, I proposed to open the public record to input by market and state actors during the examination process and throughout the lifetime of the patent, using blockchain or other technology. During the examination period, third parties could submit prior art and weigh in on obviousness. Following the patent issuance, patentees would be able to register updates to the patent, the underlying invention, or products that rely on it. They will also be able to offer licenses via smart contracts or otherwise. The court system would add to the record cases that pertain to the patent. That article argued that decentralization could improve the productivity and effectiveness of the patent system and accelerate the introduction of inventions to the market.[12]

In this chapter, I explore the possibility that decentralization could boost equality in the system by removing access barriers and turning the patent record into an effective platform to learn about inventions and commercialize them affordably. The first part of this chapter discusses the principle of equality in patent law in theory and practice. The second part explores the distributive problems that the current system entails and the future improvements for equality with the shift to a decentralized architecture. A short conclusion ensues.

9.1 EQUAL ACCESS TO THE PATENT SYSTEM

In theory, equal access is a key feature of the patent system.[13] With few exceptions, patent law abides by a strict nondiscrimination principle.[14] Neither the examination

[10] *See infra* Section 9.1.

[11] Lital Helman, *Decentralized Patent System*, 20 NEV. L.J. 68 (2019).

[12] *Id.*

[13] *See* Agreement on Trade-Related Aspects of Intellectual Property Rights art. 21.1, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299 ("[P]atents shall be available and patent rights enjoyable without discrimination as to . . . the field of technology."); Lowell v. Lewis, 15 F. Cas. 1018, 1019 (Cir. Ct. D. Mass. 1817) (stating that inventions need to compete in the marketplace); Madhavi Sunder, *IP*^{3}, 59 STAN. L. REV. 257, 259 (2006) (noting that "intellectual property utilitarianism does not ask who makes the goods"); Lee, *supra* note 4, at 328–29 ("In theory, the patent system creates a neutral market for technology that enables the invisible hand of supply and demand to allocate resources for technological development.").

[14] A notable exception is set forth in the Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 25, 125 Stat. 284 (2011) (allowing for "prioritization of examination of applications for products, processes, or technologies that are important to the national economy or national competitiveness"). Notably, the exception advances applications in the queue but grants no superior rights. Other exceptions include specific arrangements for specific contexts, such as patent term extension. *See supra* note 2. Courts also offer differential treatment de facto in different

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criteria nor the rights attached to patents grant favorable treatment to inventors based on their experience, size, financial status, or the likelihood that the invention would be valid as a patent, manufactured or sold.[15]

Nondiscrimination is a crucial principle. It ensures that all inventors, including small entities and members of marginalized communities, have an equal chance to protect their inventions. Consequently, under the assumption that patents incentivize invention, the equality principle augments everyone's incentives to invent.[16] Beyond its distributive value, the equality promise is designed to increase innovation gains by diversifying the inventive base.[17] A broad pool of inventors can yield a diversity of products, markets, and processes because different founders see different innovation needs.[18] In particular, inventors from underrepresented groups can tackle issues that sit in the blind spots of others or address well-known problems with more inclusive solutions.[19] Access of small technology companies to the patent system bears particular importance.[20] Small entities are both disproportionately innovative and crucially dependent on patents to secure funding and market entry.[21] Yet small

industries. See, for example, James Bessen & Michael J. Meurer, Patent Failure: How Judges, Bureaucrats, and Lawyers Put Innovators at Risk (2009).

[15] *See supra* note 2.

[16] *See supra* note 13.

[17] *See* Lee, *supra* note 4, at 366 ("[D]isproportionately low participation by other groups represents a missed opportunity."); Jennifer Hunt, Jean-Philippe Garant, Hannah Herman & David J. Munroe, *Why Don't Women Patent?* 2 (Nat'l Bureau of Econ. Rsch., Working Paper No. 17888, 2012) (estimating that a gender-inclusive entrepreneurship can increase GDP per capita by 2.7 percent); W. Keith Robinson, *Protecting American Innovators by Combating the Decline of Patents Granted to Small Entities*, 88 St. John's L. Rev. 379, 385 (2014) (suggesting that increasing small-entity patenting would boost innovation); Jay Mattappally, *Goliath Beats David: Undoing the Leahy-Smith America Invents Act's Harmful Effects on Small Businesses*, 58 Loy. L. Rev. 981, 985 (2012) (arguing that small businesses' patenting can create jobs).

[18] *See* Ingrid Verheul, André Van Stel & Roy Thurik, *Explaining Female and Male Entrepreneurship at the Country Level*, 18 Entrepreneurship & Reg'l Dev. 151 (2006) (discussing differences between male and female entrepreneurship).

[19] *Id.*

[20] *See* Richard J. Rosen, *Research and Development with Asymmetric Firm Sizes*, 22 Rand J. Econ. 411 (1991) (showing small firms disproportionately patent major inventions); Anthony Breitzman & Patrick Thomas, Small Bus. Admin., Office of Advocacy, *Analysis of Small Business Innovation in Green Technologies* 11 (2011), www.sba.gov/sites/default/files/rs389tot.pdf (showing that small firms obtain more patents per employee than large firms); C.J. Isom & David R. Jarczyk, Small Bus. Admin., Office of Advocacy, *Innovation in Small Businesses: Drivers of Change and Value Use* (2009), www.sba.gov/sites/default/files/rs342tot_0.pdf (showing that small businesses' patents are substantially more likely to be among the top 1 percent of cited patents).

[21] *See* Ashish Arora & Robert P. Merges, *Specialized Supply Firms, Property Rights and Firm Boundaries*, 13 Indus. & Corp. Change 451, 454 (2004) (arguing that patents facilitate investments); Mark Lemley, *The Surprising Resilience of the Patent System*, 95 Tex. L. Rev. 1, 53 (2016) (same); Jonathan M. Barnett, *Intellectual Property as a Law of Organization*, 84 S. Cal. L. Rev. 787 (2011) (same); Lee, *supra* note 4, at 36–65 (explaining that small firms' patenting facilitates market entry); Eur. Union Intell. Prop. Off., High-Growth Firms and

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entities are less likely to make use of the patent system.[22] Guaranteeing the access of small entities to the patent system thus best furthers the objective of the patent system to promote innovation.[23]

Despite the significance of the equality principle, equal access to the patent system remains largely theoretical. As Peter Lee put it, on the ground, "the U.S. patent system has become highly corporatized and concentrated."[24] Indeed, most patents are issued to large corporations,[25] with some industries featuring extreme concentration.[26] Inequality overwhelmingly persists among individual inventors as well. Women are issued around 20 percent of patents, and only 8 percent of patents feature women as the primary inventor.[27] The rate of minority inventorship is somewhat under-researched,[28] but indications are that this rate is very low, particularly among Blacks.[29] Generally, as Dan Burk and Mark Lemley observe, "even those [patents] granted to individuals and small corporations are often incubated in large research universities."[30]

Intellectual Property Rights: IPR Profile of High-Potential SMEs in Europe (2019) (showing that patents boost the likelihood of European start-up growth).

[22] *See* Stuart J.H. Graham, Robert P. Merges, Pam Samuelson & Ted Sichelman, *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 Berkeley Tech. L.J. 1255 (2009).

[23] U.S. Const. art. I, § 8, cl. 8.

[24] Lee, *supra* note 4, at 347.

[25] See, for example, Dan L. Burk & Mark A. Lemley, The Patent Crisis and How the Courts Can Solve It 41 (2009) ("The overwhelming majority of patents today are granted to large corporations, and even those granted to individuals and small corporations are often incubated in large research universities.").

[26] See, for example, Joel Reidenberg, *Small Participants in Smartphones*, 18 Stan. Tech. L. Rev. 375, 393 (2015) (showing that 90.4 percent of smartphone-related patents belong to large companies).

[27] *See* World Intell. Prop. Org., The Global Gender Gap in Innovation and Creativity: An International Comparison of the Gender Gap in Global Patenting over Two Decades 2, 33 (2023) (finding that between 1999–2020, women were involved in 23 precent of all Patent Cooperation Treaty (PCT) applications, representing 13 percent of all inventors listed, and pointing to 31 percent of women's share in PCT filings in 2020); *see also* U.S. Pat. & Trademark Off., Where Are U.S. Women Patentees? Assessing Three Decades of Growth 1 (2022) (finding that women comprised 13 percent of U.S. patent holders by 2019); Saurabh Vishnubhakat, *Gender Diversity in the Patent Bar*, 14 J. Marshall Rev. Intell. Prop. L. 67 (2014); Jennifer Hunt, Jean-Philippe Garant, Hannah Herman & David J. Munroe, *Why Are Women Underrepresented amongst Patentees?*, 42 Rsch. Pol'y 831, 831 (2013).

[28] Data deficiency on racial participation in patenting may be decreasing, as the America Invents Act directs the PTO to "establish methods for studying the diversity of patent applicants, including those applicants who are minorities, women, or veterans." Pub. L. No. 112-29, § 29, 125 Stat. 284, 339 (2011).

[29] See, for example, Adams Nager, David Hart, Stephen Ezell & Robert D. Atkinson, Info. Tech. & Innovation Found., *The Demographics of Innovation in the United States* 10 (2016), http://www2.itif.org/2016-demographics-of-innovation.pdf (noting that minorities comprise 8 percent of innovators, with Blacks comprising about 0.5 percent); Schuster et al., *supra* note 5; 157 Cong. Rec. H4484 (daily ed. June 23, 2011) (statement of Rep. Moore) (stating that minority-owned companies hold fewer patents than other companies).

[30] *See supra* note 25.

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Several reasons for the unequal distribution of patents have nothing to do with the patent system per se. Social, economic, and other pressures force some groups out of the innovation economy and other inventive spaces.[31] Yet part of the problem, and perhaps partial solutions, may lie in issues pertaining to the patent system. The next part discusses such issues and explores the possibility that decentralizing the patent system can improve equality.

9.2 A DECENTRALIZED PATENT SYSTEM

Currently, the patent system features a rigorously centralized structure. The PTO examines patent applications, publishes the granted patents to the public, and increasingly manages postexamination proceedings.[32] While surely unintended, the centralized structure of the patent system jeopardizes equality in three main ways. First, a central examination entity involves high entry costs and requires particular know-how, including institutional knowledge. High entry costs work to the detriment of new and under-resourced inventors.[33] Second, centralization congests the system and induces patent examiners to use decision shortcuts and proxies that favor strong and repeat players. Third, the current system over-grants patents, mainly to big corporations, and these patents form barriers to entry for newcomers. Finally, the current system features an inadequate patent record that lacks vital information about inventions and frustrates the use of that record as a source for consultation in the invention ecosystem. Acquiring such information elsewhere is cost-prohibitive for small inventors, but operating without it exposes them to market and legal risks. The thesis advanced in this chapter is that decentralizing some of the PTO's functions can effectively address these concerns and boost equality.

9.2.1 *The Problems in a Centralized Patent Regime*

The most apparent distributive concern in the patent system involves high entry costs.[34] Patent prosecution has become increasingly expensive, partially due to the

[31] *See supra* note 7; *see also* Christian Kiedaisch, *Growth and Welfare Effects of Intellectual Property Rights When Consumers Differ in Income* (Univ. of Zurich, Dep't of Econ., Working Paper No. 221, 2017), www.econ.uzh.ch/static/wp/econwp221.pdf. (discussing a differential effect of another intellectual property policy – the length of intellectual property protection for rich and poor households).

[32] *See* 35 U.S.C. § 153. For scholarship regarding the administrative review of patent examination, see Sarah Tran, *Patent Powers*, 25 HARV. J.L. & TECH. 595, 599 (2012); Brian J. Love & Shawn Ambwani, *Inter Partes Review: An Early Look at the Numbers*, 81 U. CHI. L. REV. DIALOGUE 93, 94–97 (2014); Saurabh Vishnubhakat, *The Youngest Patent Validity Proceeding: Evaluating Post-Grant Review*, 24 TEX. INTELL. PROP. L.J. 333, 340 (2016); Mark Consilvio & Jonathan R.K. Stroud, *Unraveling the USPTO's Tangled Web: An Empirical Analysis of the Complex World of Post-Issuance Patent Proceedings*, 21 J. INTELL. PROP. L. 33 (2013); Paul R. Gugliuzza, *(In)Valid Patents*, 92 NOTRE DAME L. REV. 292 (2016).

[33] *See infra* Section 9.2.1.

[34] *See* Graham et al., *supra* note 22, at 1311 (reporting findings that patent acquisition costs over US$38,000).

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prolonged processes at the PTO, which compound legal and other expenses, and partly because the complexity of these processes requires expensive professionals to navigate them.[35] Patent prosecution may be even *costlier* for small inventors, who, among other things, do not have in-house patent attorneys.[36]

The financial barrier to the patent system prompted Congress to lower the filing fees for small firms and micro-entities through the Leahy-Smith America Invents Act.[37] This statute also entitles small entities and independent and unrepresented inventors to technical, pro bono, and pro se assistance.[38] Despite such measures, inequality seems to worsen with time.[39] The reduced fees have not moved the needle, most likely because these fees are negligible in the overall expenses of patent prosecution. Also, the rate of abandoned applications is more than twofold for pro se applicants than for represented applicants.[40]

High entry costs confine small companies and individuals more than well-resourced corporations. The most obvious result of costly patent prosecution is that small inventors give up on patents. While avoiding patenting may be rational for small entities,[41] it exposes their inventions to copying and may yield an inferior position in the marketplace.[42] Indeed, the rise of trade secrets protection provides alternative, cheaper protection that often suits better the financial capabilities, focus, and business of small entities and individual inventors.[43] Yet, if patents exist as a tool to generate an incentive to create, then the exclusion of certain groups from

[35] *Id.*; *see also* Gene Quinn, *Patent Search 101: Why US Patent Searches Are Critically Important*, IPWatchdog (Jan. 13, 2018), https://ipwatchdog.com/2018/01/13/patent-search-101-patent-searches. ("[B]efore spending thousands of dollars to obtain a patent you should obtain a professional patent search and patentability opinion.").

[36] Graham et al., *supra* note 22, at 1311–12 (quoting a technology executive).

[37] 35 U.S.C. § 41(h)(1) (2012); 37 C.F.R. § 1.16.

[38] *See* Pub. L. No. 112-29, § 28, 125 Stat. 339 (2011); Jennifer M. McDowell & Saurabh Vishnubhakat, *The USPTO Patent Pro Bono Program*, 7 Cybaris Intell. Prop. L. Rev. 1 (2015); Lee, *supra* note 4, at 350–51 (describing the development of the assistance programs).

[39] Lee, *supra* note 4, at 347 n.161 (showing trends); Dennis Crouch, *Small Entity Status*, Patently-O (Feb. 12, 2013), https://patentlyo.com/patent/2013/02/small-entity-status.html (showing that patent filings by small entities declined from approximately 30 percent in 1990 to approximately 18 percent in 2010).

[40] *See* Kate S. Gaudry, *The Lone Inventor: Low Success Rates and Common Errors Associated with Pro-Se Patent Applications*, 7 PLoS ONE e33141, at 3 (2012).

[41] *See* Susan C. Morse, *Entrepreneurship Incentives for Resource-Constrained Firms*, *in* The Cambridge Handbook of Law and Entrepreneurship in the United States 197, 199–200 (D. Gordon Smith, Brian Broughman & Christine Hurt eds., 2022) ("[C]apital is often available to a resource-constrained firm in discrete portions, and not continuously. Therefore, a resource-constrained startup often faces a zero-sum tradeoff between making a legal incentive investment and spending on its business."); Lital Helman, Innovation Policy and the Valley of Death (2022) (unpublished manuscript) (on file with author).

[42] *See* Ted Sichelman & Stuart J.H. Graham, *Patenting by Entrepreneurs: An Empirical Study*, 17 Mich. Telecomm. & Tech. L. Rev. 111, 115 (2010) (reporting surveys that show that cost is the main reason start-ups avoid patenting).

[43] *See* Lital Helman, *Trade Secrets and Personal Secrets*, 55 U. Rich. L. Rev. 447, 453–56 (2020); David S. Levine & Ted Sichelman, *Why Do Startups Use Trade Secrets?*, 94 Notre Dame

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patenting adversely affects their incentives to invent.[44] But high costs can be even more devastating; small inventors depend on investments, but investors are reluctant to fund patent prosecution and often delay investments until patents are secured.[45] Consequently, inventors may be forced to relinquish their ventures altogether or settle for lower valuations than their invention is worth.[46]

Consider now the backlog of the patent system. Currently, the PTO examines all patent applications alone, generating severe delays.[47] A high pendency rate has a differential effect on the market. For small players, pendency shrinks the duration and thus the value of patent protection.[48] Big players, in contrast, can make lemonade out of the long application process lemon. Such players can file numerous broad patents, including for embryonic ideas that did not go through full development or feasibility testing. They can then strategically use the "patent pending" status of their applications to persuade others to back away from their asserted territory during the long examination period, even if the application would eventually be denied or reduced in scope.[49]

The backlog at the PTO potentially affects the incentives of examiners as well.[50] While probably unintended, proxies for validity – such as inventors' names, former

L. Rev. 751, 758–60 (2019) (showing that trade secrets are better tailored to software start-ups and the like).

[44] *See* U.S. Const. art. I, § 8, cl. 8. Doubts that patents actually promote innovation abound. See, for example, Bessen & Meurer, *supra* note 14, at 14, 16 (arguing that patents promote innovation only in some industries); Lemley, *supra* note 21, at 52 ("[P]ersuasive evidence that the patent system drives innovation is surprisingly hard to come by."); Petra Moser, *How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World's Fairs*, 95 Am. Econ. Rev. 1214, 1221 (2005) (finding that patents promote innovation when copying or reverse engineering are easy in a particular industry).

[45] *See supra* note 21.

[46] *See* Arti Rai, Stuart Graham & Mark Doms, Patent Reform: Unleashing Innovation, Promoting Economic Growth & Producing High-Paying Jobs: A White Paper from the U.S. Department of Commerce 1 (2010), www.commerce.gov/sites/default/files/documents/migrated/Patent_Reform-paper.pdf (noting that problems in the patent system could lead to "foregone innovation").

[47] *See* U.S. Pat. & Trademark Off., The Future Performance & Accountability Report 15 (2017), www.uspto.gov/sites/default/files/documents/USPTOFY17PAR.pdf (noting a two-year pendency); Ron A. Katznelson, *My 2010 Wishes for the U.S. Patent Examiner* 85 (2010), http://j.mp/RDK-2010-wishes (criticizing the nontransparent measures by which the PTO measures pendency); Mark A. Lemley & Bhaven Sampat, *Examining Patent Examinations*, 2010 Stan. Tech. L. Rev. 2, 3 (2009) (discussing patent pendency).

[48] 35 U.S.C. § 154(a)(2) (providing that patents shall last for a "term beginning on the date on which the patent issues and ending 20 years from the date on which the application for the patent was filed in the United States").

[49] *Cf.* Lemley, *supra* note 21, at 53–54 (noting that patent applications may be filed for reasons unconnected to their validity).

[50] *See* Michael D. Frakes & Melissa F. Wasserman, *Is the Time Allocated to Review Patent Applications Inducing Examiners to Grant Invalid Patents?: Evidence from Micro-Level Application Data*, 99 Rev. Econ. & Stat. 550 (2017) (hereinafter Frakes & Wasserman, *Is the Time Allocated*); Michael D. Frakes & Melissa F. Wasserman, *Empirical Scholarship on the Prosecution Process at the PTO*, *in* 2 Research Handbook on the Law & Economics of

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acquaintance with the representing agent, and institutional affiliation – are almost inevitable considering the severe examination backlog at the PTO and the time constraints imposed on examiners.[51] These biases are compounded by the notorious public choice problems at the PTO that further the interests of large corporate patent filers and other repeat players at the expense of smaller inventors.[52] Institutional capture easily penetrates into the individual level of examiners, who may be contemplating their next career step as patent prosecutors or major patent holders.[53]

The third challenge that the extant regime poses to equality concerns the prevalence of low-quality patents. The issue of patent quality has long troubled patent scholars.[54] From the equality prism, the concern is that the PTO is biased

Intellectual Property 77 (Peter S. Menell, David L. Schwartz & Ben Deporter eds., 2019) (hereinafter Frakes & Wasserman, *Empirical Scholarship*) ("[A]n examiner, on average, spends only 19 hours reviewing a patent application, including reading the patent application, searching for prior art, comparing the prior art with the patent application, writing a rejection, responding to the patent applicant's arguments, and often conducting an interview with the applicant's attorney."); Gene Quinn, *High Value Patents – Where Strength Meets Quality*, IPWatchdog (Dec. 11, 2014), www.ipwatchdog.com/2014/12/11/high-value-patents-where-strengthmeets-quality/id=52569/ ("It is unrealistic to expect an examiner to thoroughly review an average of nearly 50 references per patent in the 16 to 17 hours an examiner can spend per patent while processing the necessary number of patent applications." (quoting Stephen Kunin, former Deputy Commissioner for Patent Examination Policy)).

[51] See, for example, Kyle Jensen, Balázs Kovács & Olav Sorenson, *Gender Differences in Obtaining and Maintaining Patent Rights*, 36 Nature Biotech. 307, 308 (2018) (finding more rejections of patents filed by inventors with female names); Gaétan de Rassenfosse, Paul Jensen, T'Mir Julius, Alfons Palangkaraya & Elizabeth Webster, *Who Monitors TRIPS?* (Swinburne Ctr. for Transformative Innovation, Working Paper No. 4/18, 2018), www.swinburne.edu.au/media/swinburneeduau/research/research-centres/cti/working-papers/CTI-Working-Paper_4-18_Who_Monitors_TRIPS.pdf (finding bias against foreign patent applicants); *Lost Einsteins: Lack of Diversity in Patent Inventorship and the Impact on America's Innovation Economy: Hearing before the Subcomm. on Courts, Intell. Prop., and the Internet of the H. Comm. on the Judiciary*, 116th Cong. 84–85 (2019) (statement of Lisa D. Cook, Department of Economics, Michigan State University) (proposing blind patent review).

[52] *See* Shobita Parthasarathy, Patent Politics: Life Forms, Markets, and the Public Interest in the United States and Europe 27–28 (2017) (discussing the influence of patent professionals, big corporations, and PTO personnel on the design of the patent system); Burk & Lemley, *supra* note 25, at 107 ("It is little wonder . . . that the USPTO in the 1990s stated its mission as 'to help our customers get patents.' That's capture."); John M. Golden, *Patentable Subject Matter and Institutional Choice*, 89 Tex. L. Rev. 1055, 1098 (2011) ("USPTO examiners primarily interact with parties seeking to obtain patent rights. There is therefore natural cause for concern that USPTO personnel will become subject to a form of intellectual or informational capture and tend to view the world through patent applicants' lenses.").

[53] *See* Golden, *supra* note 52, 1100–01 (speculating that patent attorneys "might exert a strong gravitational pull on an administrative agency that works nearly exclusively with such lawyers and agents in adjudicative contexts, and many of whose personnel might contemplate a later career in patent prosecution"); Corinne Langinier & Philippe Marcoul, *Monetary and Implicit Incentives of Patent Examiners* (Univ. of Alberta, Dep't of Econ., Working Paper No. 2009-22, 2009) (discussing career considerations of PTO examiners).

[54] See, for example, Frakes & Wasserman, *Empirical Scholarship*, *supra* note 50, at 77 ("There is widespread agreement that the [PTO] allows too many invalid patents"). For discussions of

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toward granting patents, de facto disadvantaging small inventors who file fewer patents and must penetrate a dense screen of patents to function. Remarkably, Alberto Galasso and Mark Schankerman find that innovation by small firms is often triggered by invalidating large firms' patents, suggesting that those patents thwart innovative efforts.[55]

A key reason for the over-grant bias is that the PTO has limited access to the information and proficiency required to disqualify patents and insufficient time to acquire such information and proficiency.[56] Indeed, patent applications must be granted absent reasons to deny them.[57] But assessing applications' novelty and nonobviousness typically requires highly contextual, fact-intensive, industry-specific information (to disqualify patents based on a lack of novelty) and very specific expertise (to deny patents based on their obviousness).[58] Such knowledge is naturally dispersed in society rather than concentrated in one agency.[59]

What is more, the incentives of the PTO are set up to make it an ineffective gatekeeper for patent quality. The PTO is largely self-funded by patentees' fees, generating an institutional disincentive to reject patents.[60] Studies even indicate that the PTO grants more patents in areas where fees are higher.[61] To avoid time-

costs that low-quality patents generate, see, for example, Fed. Trade Comm'n, To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy 5–7 (2003); Bessen & Meurer, *supra* note 14, at 3; Adam B. Jaffe & Josh Lerner, Innovation and Its Discontents: How Our Patent System Is Endangering Innovation and Progress, and What to Do about It 11–13 (2004); Shubha Ghosh & Jay Kesan, *What Do Patents Purchase? In Search of Optimal Ignorance in the Patent Office*, 40 Hous. L. Rev. 1219, 1227–35 (2004); Roger Allen Ford, *The Patent Spiral*, 164 U. Pa. L. Rev. 827 (2016); T.R. Beard, George S. Ford, Thomas M. Koutsky & Lawrence J. Spiwak, *Quantifying the Cost of Substandard Patents: Some Preliminary Evidence*, 12 Yale J.L. & Tech. 240 (2010).

[55] *See* Alberto Galasso & Mark Schankerman, *Patents and Cumulative Innovation: Causal Evidence from the Courts*, 130 Q.J. Econ. 317, 322 (2015).

[56] *See* Gregory Mandel, *The Non-Obvious Problem: How the Indeterminate Nonobviousness Standard Produces Excessive Patent Grants*, 42 U.C. Davis L. Rev. 57 (2008); Rebecca S. Eisenberg, *Obvious to Whom – Evaluating Inventions from the Perspective of PHOSITA*, 19 Berkeley Tech. L.J., 885, 887 (2004) ("An invention that seems obvious to a person having ordinary skill in the field might nonetheless seem patentworthy to a person who lacks such skill, even after reading the prior art record."); *see also supra* note 50.

[57] *See* Frakes & Wasserman, *Is the Time Allocated*, *supra* note 50, at 552 (discussing the "presumption of validity").

[58] See, for example, John R. Thomas, Tailoring the Patent System for Specific Industries 3–4 (2015), https://fas.org/sgp/crs/misc/R43264.pdf (discussing the diversity of inventions and patents).

[59] *See* Craig Allen Nard & John F. Duffy, *Rethinking Patent Law's Uniformity Principle*, 101 Nw. U. L. Rev. 1619, 1631 (2007) ("Within economics there exists the basic assumption that having multiple information gathering points – multiple private actors operating in markets – allows for the generation of more complete and reliable data.").

[60] *See* Omnibus Reconciliation Act of 1990, Pub. L. No. 101-508, § 10101, 104 Stat. 1388, 1388–91 (explaining examination fee, issuance fee, and annual maintenance fee).

[61] *See* Michael Frakes & Melissa Wasserman, *Does Agency Funding Affect Decision Making?: An Empirical Assessment of the PTO's Granting Patterns*, 66 Vand. L. Rev. 67 (2014) (finding support for the hypothesis that the PTO's fee structure incentivizes over-granting patents).

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consuming disputes, a swamped PTO is also better off granting borderline patents, particularly to applicants who will likely challenge rejections.[62]

Finally, another way that a centralized patent system contributes to inequality concerns information problems in the patent record. Naturally, a PTO-operated patent record can only include information that the PTO possesses at the time of publication.[63] But such a record is gravely deficient. The current record lacks information about the background science of the invention and any developments since it was filed. Neither does it include information relating to litigations or transactions, such as available licenses and prices.[64] However, its immense value, including robust information in the patent record, is unrealistic under a centralized model. The PTO has no access to the information that is most relevant to make the record useful for the inventive community. Much of this information is also dynamic and is changing over time. A central agency cannot realistically be responsible for collecting and registering updates to the record.

An inhibited record has distributive effects. Highly capitalized inventors can overcome information deficiencies by investing in other methods to acquire information, which is cost-prohibitive for small players.[65] But running an underinformed business involves market and legal risks. The main risk concerns exposure to "patent trolls" – nonpracticing entities who accumulate vast portfolios of dubious patents and use them for strike suits against innocent infringers.[66]

[62] *See* Joseph Scott Miller, *Building a Better Bounty: Litigation-Stage Rewards for Defeating Patents*, 19 Berkeley Tech. L.J. 667, 687–88 (2004) (showing that challenging unmerited grants is rare); Roger Allen Ford, *Patent Invalidity versus Noninfringement*, 99 Cornell L. Rev. 71, 110 (2013) (same); John R. Thomas, *Collusion and Collective Action in the Patent System: A Proposal for Patent Bounties*, 2001 U. Ill. L. Rev. 305, 333 (2001) (same); Lemley, *supra* note 21, at 44 (same).

[63] *See* 35 U.S.C. § 122(b)(1); 37 C.F.R. § 1.211 (2018).

[64] *See* 35 U.S.C. § 112(a); *313 Recording of Licenses, Security Interests, and Documents Other than Assignments [R-07.2015]*, U.S. Pat. & Trademark Off., www.uspto.gov/web/offices/pac/mpep/s313.html (last visited Oct. 5, 2019); *Search for Patents*, U.S. Pat. & Trademark Off., www.uspto.gov/patents-application-process/search-patents (last visited Nov. 13, 2019) (detailing the items the record entails).

[65] Large companies typically run a mergers-and-acquisitions department to actively look for companies with complementary technology, often to identify acquisition opportunities. Market analysis providers are also providing such services. See, for example, *Find Investments*, Crunchbase, www.crunchbase.com (last visited Oct. 8, 2019); *About Our Company*, Dun & Bradstreet, www.dnb.com/about-us/company.html (last visited Oct. 8, 2019). Free patent search tools exist, but they are limited and may also be tracking searches for the benefit of their operators. See, for example, Google Patent Search (www.google.com/patents) and Free Patents Online (www.freepatentsonline.com/). Free tools to obtain transactional and other patent-related information are not readily available.

[66] See, for example, Mark A. Lemley & Doug Lichtman, *Rethinking Patent Law's Presumption of Validity*, 60 Stan. L. Rev. 45, 48 (2007) ("Sadly, a large and growing number of 'patent trolls' today play this exact strategy, using patents on obvious inventions quite literally to tax legitimate business activity.").

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These problems did not go unnoticed, and Congress, courts, and the PTO have attempted to tackle some of them.[67] Yet, high costs, congestion, information problems, and capture are inherent to a centralized PTO and will render any solution that maintains the current structure partial at best. Next, I explore whether decentralizing some PTO functions can provide a better way forward.

9.2.2 *Can Decentralization Provide a Solution?*

Imagine that the power to write information into the record was not exclusive to the PTO but distributed among state and market actors. The patent record would be built on a blockchain or another platform that enables the autonomous sharing of information by authorized parties.[68] Such parties would be able, and in some cases obliged, to update the record with relevant information during the examination process and throughout the duration of the patent. Under a decentralized model, third parties and scientists could submit prior art and weigh in on obviousness for the use of examiners during the examination period. After patents are issued, patentees could include in the record commercial information, such as licensing and pricing information, and even plug-in smart contracts. Courts would list decisions and outstanding cases that pertain to the patents. These updates would inform the patent community whether patent claims are in question, whether the patent holder is prone to litigation, and other useful information that is costly to obtain under the extant regime. The PTO would be responsible for reviewing the patent record and fixing errors.

In my previous work, I tackled the practical aspects of this proposal and the related concerns.[69] The main concern revolves around whether there are adequate incentives for market players to contribute to a decentralized record. This is a critical point. After all, a functioning patent record is a public good. Without private incentives to participate in it, the record would be unable to achieve its goals.

The first answer to that concern is that some contributions to the decentralized record would be automatic or mandatory and would be independent of the

[67] *See* Helman, *supra* note 11, at 83–84 (describing measures taken to fix the system).

[68] Blockchains are a type of distributed data containers that enable recording transactions without central management or intermediaries. *See* Jean Bacon, Johan David Michels, Christopher Millard & Jatinder Singh, *Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers*, 25 Rich. J.L. & Tech., no. 1, 2018; Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller & Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction (2016); Primavera De Filippi & Aaron Wright, Blockchain and the Law: The Rule of Code (2018); Don Tapscott & Alex Tapscott, Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World (2016). Blockchain is a good candidate for a patent registry due to its distributed nature, which can enable time-stamped registration of patents, sharing robust information about them, and commercializing them autonomously. Yet, this chapter explicitly shuns proposing a particular technology. New technologies can be developed in the future that would be at least as fitting for this task.

[69] *See* Helman, *supra* note 11, at 104–11.

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participants' goodwill. For example, patent applications would be fully published, with automatic references to similar materials on the record;[70] information about litigations would be added by courts as created, and patentees would be obliged to maintain the accuracy of the information on available licenses. This information would already be a substantial improvement over the current regime.

Consider now the incentives for market players to participate in the system voluntarily. It is relatively easy to see the incentives for patentees to add licensing information to the record. Adding such information would enable patentees to commercialize their inventions without much effort. Some patentees, such as big pharmaceutical companies, may prefer to continue licensing their patents individually.[71] Yet, this functionality can be extremely valuable for small companies or individual patentees that do not have resources to negotiate each license individually, as well as for owners of vast patent portfolios who can build a cost-effective licensing model.

How about the interests of third parties to contribute information to the record? During the examination process, firms would be incentivized to question the validity of patents that would curb their free operations. From their point of view, this mechanism would be a cheaper, easier way to battle a patent than postreview examination, let alone litigation.[72] The concern may be that such parties would be *too* eager to provide invalidating information in a way that would jeopardize the efficiency of the system. My previous work addressed this concern.[73]

Other contributors, such as academics or scientists, may be motivated to participate by other considerations, such as reputation or exposure to new information in their field. Volunteer reviewers are the regular case in many academic frameworks, such as reviews of submissions to scientific journals and grants. It would thus not be surprising to see scientists weigh in on an invention in their field.[74] At the postexamination stage, technology firms and scientists would be incentivized to update and consult the record as an affordable mechanism to avoid infringements, as well as to learn of new inventions and form collaborations.

[70] See, for example, Richard J. Gilbert & Michael L. Katz, *Should Good Patents Come in Small Packages? A Welfare Analysis of Intellectual Property Bundling*, 24 Int'l J. Indus. Org. 931, 931 (2006) (discussing how some patents are connected).

[71] See, for example, Helsinn Healthcare v. Teva Pharm. USA, Inc., 855 F.3d 1356, 1364, 1367–68 (Fed. Cir. 2017) (noting that individual licensing enables patentees to enter differential contracts and to keep licensing terms confidential).

[72] For discussion and comparison between the PTO and court postreview and appeal procedures, see, for example, Consilvio & Stroud, *supra* note 32, at 41–42; Gugliuzza, *supra* note 32, at 272–73 (criticizing the inconsistencies resulting from parallel jurisdiction of the PTO and courts); Saurabh Vishnubhakat, Arti K. Rai & Jay P. Kesan, *Strategic Decision Making in Dual PTAB and District Court Proceedings*, 31 Berkeley Tech. L.J. 45, 69–70 (2016) (comparing litigants' use of Patent Trial and Appeal Board procedures and Article III litigation).

[73] *See* Helman, *supra* note 11.

[74] *See* Daryl E. Chubin & Edward J. Hackett, Peerless Science: Peer Review and U.S. Science Policy 91–95 (1990).

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Decentralizing the patent record could transform the record from a static database that includes basic filing information that is barely used in the industry into an up-to-date platform that forms a central tool in the innovation economy. This strategy can potentially improve equality in the patent system in three main ways. First, it would tackle distributive concerns in the patent examination process. Second, it would protect small inventors from information problems. Third, it would boost the commercialization of patents, particularly for small inventors.

Consider first how decentralization can cure distributive harms in the examination process. As discussed, the patent prosecution process is done ex parte under the current regime. However, market actors hold superior information, such as knowledge of instances where the invention was offered for sale or disclosed publicly.[75] The PTO alone is entrusted with raising arguments to reject the patent or narrow down its claims.[76] It performs this task in a suboptimal manner, under time and knowledge constraints.[77] Decentralization would make invalidating information handily available to examiners and reduce the rate of low-quality patents, which form entry barriers for small players. A broader information basis would also save examiners search time and attenuate their need to rely on proxies, which have discriminatory effects.

Even greater equality can be found in the postexamination period. An updated patent record would provide a cost-effective means to gain useful technological, transactional, and legal information throughout the duration of the patents. Making robust information available to small players levels the playing field between them and big players, rendering it less likely that entrenched firms could learn about patents and new players in their field more than start-up ventures.[78] Tackling information problems would also enable innovators to avoid infringements, thus battling patent strike suits, which can devastate small entities.

Finally, decentralization of the record would introduce a platform to commercialize inventions globally. Patentees could list licensing options, potential use cases, and prices on the patent record. Once the record contains such robust transactional information, cooperation with commercial bodies to bring the invention to the

[75] *See Helsinn Healthcare*, 855 F.3d at 1371 (holding that secret agreements can also preclude novelty).

[76] Timothy B. Lee, *Why the Roots of Patent Trolling May Be in the Patent Office*, Ars Technica (Mar. 5, 2018), https://arstechnica.com/tech-policy/2018/03/why-the-roots-of-patent-trolling-may-be-in-the-patent-office/ ("Patent examiners do not just decide whether or not to approve a patent. They're also supposed to narrow a patent's claims to make sure it only covers what the inventor actually invented."); *cf.* 35 U.S.C. 122(e) (sets forth the third-party preissuance submissions).

[77] *See supra* Section 9.1.

[78] *See supra* note 65.

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market is much more likely.[79] A distributed registry could also enable functionality not existing today, such as plugging in smart contracts and allowing third parties to act on available licenses automatically.[80] This functionality can be extremely valuable for small companies or individual patentees that do not have resources to negotiate each license individually.

The benefit of this policy is twofold. First and foremost, the dynamic record can further the goal of the patent system – to accelerate the path of innovation to the market.[81] Second, improved commercialization would have a dynamic effect. It could spur innovation and patenting because patents would become an effective reward for inventors.[82]

CONCLUSION

The technological ability to decentralize the power to write into the patent record presents intriguing opportunities to generate a patent system that is more inclusive and diverse and to address the pressing issues of equality in the patent system.

An intriguing question can arise in this context: Considering the pledged efficiency of a blockchain-based database for inventions, why has the market not stepped in to create such a registration itself? The answer to this question is that some trading platforms between inventors and licensees exist worldwide.[83] Yet, without regulation, these platforms are underdeveloped. The first reason is that the market does not internalize the distributive concerns discussed in this chapter, and therefore market-based registries may not develop as efficiently as they should. In this vein, a second issue with market initiatives concerns information and collective action problems. Too many actors from various industries and jurisdictions need to join together to generate an effective patent record on the free market.

Yet the most fundamental reason is that it is simply more efficient to decentralize the state-run patent registry than to create a new registry, especially when distributive concerns are considered. The patent registry is a legal creature. It is set by the law and operates under the controlling statutes in each country. Thus, market initiatives

[79] *See* Mark A. Lemley, *Faith-Based Intellectual Property*, 62 UCLA L. Rev. 1328, 1334 (2015) (noting that the lion's share of patents today is never commercialized, licensed, or used).

[80] *See* Pierluigi Cuccuru, *Beyond Bitcoin: An Early Overview on Smart Contracts*, 25 Int'l J.L. & Info. Tech. 179 (2017).

[81] *See* Gaia Bernstein, *In the Shadow of Innovation*, 31 Cardozo L. Rev. 2257, 2259 (2010) ("Attaining the progress objective . . . requires not just innovation but also an adoption process. Progress can be attained only if people adopt and use the new technology.").

[82] Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 Tex. L. Rev. 1031, 1031 (2005) ("Intellectual property protection in the United States has always been about generating incentives to create.").

[83] See, for example, *Who We Are*, Bernstein, www.bernstein.com (last visited Oct. 8, 2019).

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cannot *replace* the existing record, but they can rather duplicate the platform and add to it. This reality harms efficiency and generates distributive harm by adding another registry and multiplying registration costs. At the end of the day, while a market-based scheme has its advantages, it would be more efficient to channel the resources and efforts that are already being made for patent registration to a registry that is valuable to the market.

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